COMPUTER GENERATED TRANSLATION OF JP 2002-310710 FILED 10/23/2002

CLAIMS

[Claim(s)]

[Claim 1] The path-planning guide apparatus equipped with a path-planning means search for the guidance path from an origin to the destination, a road cost count means calculate the road cost which shows guidance need, respectively about two or more roads on said guidance path for which it was searched, a road selection means choose the road of one or more high high orders of road cost from said calculated road costs, and a voice guidance means perform voice guidance about said selected road.

[Claim 2] The path planning guide apparatus according to claim 1 characterized by multiplying the mileage of each of two or more of said roads by the weighting factor for every road classification, and performing count of said road cost.

[Claim 3] The path planning guide apparatus according to claim 2 characterized by being characterized by setting road cost as max to the first turnpike when two or more turnpikes are included on said guidance path.

[Claim 4] By count of said road cost, general paths other than a national highway are

path planning guide apparatus according to claim 2 or 3 characterized by totaling and regarding it as one road.

[Claim 5] It is a path planning guide apparatus given in either of claims 2-4 characterized by excepting from count of road cost about the road below a predetermined rate to a total process distance of a guidance path.

[Claim 6] It is a path planning guide apparatus given in either of claims 2-4 characterized by reducing road cost at a predetermined rate on the occasion of count of road cost about the road below a predetermined rate to a total process distance of a guidance path.

[Claim 7] A path planning guide apparatus given in either of claims 1-6 characterized by carrying out voice guidance of the name of entrance interchange with the name of the road when the turnpike is included by said selected road.

[Claim 8] A path planning guide apparatus given in either of claims 1-7 characterized by carrying out voice guidance at the order of a transit path when there are two or more said selected roads.

[Claim 9] The path planning guidance approach characterized by calculating road cost by multiplying the mileage of each of two or more of said roads by the weighting factor for every road classification, choosing the road of one or more high high orders of said road cost, and performing voice guidance about two or more roads on the guidance path from the origin obtained by carrying out path planning to the destination.

[Claim 10] The program which realized the path planning guidance approach indicated to the path planning guide apparatus or claim 9 indicated to claims 1-8 by software

[claim 11] The record medium which recorded the program indicated to claim 10.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the path planning guide apparatus which performs the path planning from an origin to the destination, and performs voice guidance on the road through which it passes.

[0002]

[Description of the Prior Art] Conventionally, although this kind of path planning guide apparatus has been used mainly for the navigation equipment for mount, it is used for the navigation equipment of a cover half installed in navigation equipment, a portable drive-in, or a portable service area in recent years.

[0003] Drawing 6 is the block diagram showing the outline configuration of the conventional navigation equipment for mount. In drawing 6 , the bearing sensor 1 detects relative transit bearing of an automobile, and an oscillating gyroscope is used. A speed sensor 2 generates the pulse according to the rotational frequency of a wheel, and detects the vehicle speed. The various sensors 3 output on-off signals, such as a brake switch and a parking switch, the signal for a supply voltage monitor, etc. The sensor signal-processing section 4 processes the sensor signal from the bearing sensor 1, a speed sensor 2, and various sensor 3 grades. The GPS receiver 5 asks for the location (LAT, LONG) of a receiving point by receiving the electric wave transmitted from two or more GPS Satellites, and performing data processing. DVD-ROM drive 6 reads map data from DVD-ROM7 which is the record medium with which map data were recorded. The display control unit 8 installed in the vehicle interior of a room had liquid crystal

display 8A which displays the current transit location of a map and an automobile, bearing, etc., and the touch panel 8B which have been arranged in the front face, and equips touch panel 8B with the switch for directing expansion of a display map, contraction, etc., the switch which direct path planning, the switch which choose the destination from the name of a places displayed on liquid crystal display 8A. In the GPS receiver 5, DVD-ROM drive 6, the display control unit 8, etc., it connects with a coaxial cable and the body 9 of equipment is arranged in a trunk room etc.

[0004] The program ROM 11 which is the read-only or rewritable memory various kinds of operation programs which perform the body 9 of equipment by CPU (central processing unit)10 and CPU10 which perform various kinds of operations were remembered to be DRAM12 which is the memory which memorizes the data from the bearing sensor 1, a distance robot 2, the various sensors 3, the GPS receiver 5, and CD-ROM drive 6 grade, the result of an operation in CPU10, etc., and in which write-in read-out is possible at any time, SRAM13 which is the memory for the backup for holding required data also when the current supply to the body 9 of equipment stops, Kanji font ROM14 which is the read-only memory which memorizes patterns displayed on liquid crystal display 8A, such as an alphabetic character and a notation, The image processor 15 for forming a display image based on map data, the current position data of a self-vehicle, etc., VRAM16 which is the image memory which compounds kanjis, such as a name of a town outputted from the map data, the current position data, and kanji font ROM14 which are outputted from CPU10, and a road name, and a font, and is displayed on liquid crystal display 8A, The RGB conversion circuit 17 for changing the output data of VRAM16 into a chrominance signal, and outputting to liquid crystal display 8A, The communication interface 18 which controls the communication link

between the body 9 of equipment, the display control unit 8, DVD-ROM drive 6, and the GPS receiver 5, It has the voice processor 19 which creates a predetermined voice-told message based on the command of CPU10, and the loudspeaker 20 which outputs the created voice-told message as voice.

[0005] Drawing 7 is a format of the map data stored in DVD-ROM7, and serves as DISUKURABERU 21, the drawing parameter 22, the map leaf management information 23, and a map leaf 24 from path planning data 25 grade. Background data, alphabetic data, road data, etc. are memorized by the map leaf 24, and the data for every unit map which divided the topographical map of the Japan whole country by the LAT and LONG are memorized. Even the map leaf which described the narrow area in the detail from the map leaf which described the large area coarsely is set to the map leaf 24. Each map leaf consists of map display level A, B, and C which described the same area. From B, C is described by B from A and the map display level A, B, and C is described more by the detail. Moreover, the every place Fig. display level A, B, and C consists of map display level management information and two or more units. A unit describes the division area which divided the area of every place Fig. display level into plurality, and each unit consists of a unit header, an alphabetic character layer, a background layer, a road layer, an option layer, etc. memorize the data (for example , the node number of a node) about the coordinate point (the node) and the line (the link) which describe the road which record the name of a place display on a map , a road name , a facility name , etc. on an alphabetic character layer , and the data for draw a road and a facility be record on a background layer , and include a crossing in a road layer , a LAT , LONG , the link number of a link , link distance , etc. In addition, the data recorded on the road layer do not participate in a map display directly, but are used for it as road-system

information for map matching.

[0006] Retrieval data are recorded for every hierarchy even to the hierarchy n for a large area from the hierarchy 0 for the area where the path planning data 25 are narrow. Each hierarchy's retrieval data consist of the node connection data 26, link cost data 27, a path indicative data 28, voice data 29, etc. The node connection data 26 are each node a-g and data in which it is shown with which node X and Y are connected, as shown in drawing 8 , for example, they are data in which connecting with Nodes a, d, f, and Y about Node c is shown. Moreover, the link cost data 27 show the link cost of the link between each node, the link cost of the link between Node a and Node c is "5", for example, the link cost of the link between Node a and Node b shows ["10" and the link cost of the link between Node a and Node d] that it is "20." And this link cost is called for from link cost = link distance / whenever [setting speed], and as whenever [setting speed] is shown in drawing 9 , it is set up according to road classification and the width of street. Moreover, data for the path indicative data 28 to display the path chosen by path planning on a display map are recorded. Voice data 29 is recorded as digital data, the SUPIKAHE output of this voice digital data is carried out from amplifier via a D/A converter, a filter, etc., and voice guidance is reproduced.

[0007] Next, actuation of the conventional navigation equipment constituted as mentioned above is explained. In drawing 6 , the output of the bearing sensor 1, a distance robot 2, and the various sensors 3 is sent to CPU10 through the sensor processing section 4. In CPU10, the operation of the current position of a self-vehicle is performed and the LAT of the current position and LONG are called for. Moreover, amendment of the current position is performed based on the data from the GPS receiver 5. Thus, based on the called-for current position, the map data of the unit

corresponding to the current position are read from DVD-ROM7 by DVD-ROM drive 6, and this map data is stored in DRAM12 through the communication link interface 18. Some map data stored in DRAM12 are read by CPU10, it is changed into image data by the image processor 15, and is written in VRAM16. The image data stored in VRAM16 is changed into a chrominance signal by the RGB conversion circuit 17, and is sent to liquid crystal display 8A, and the map of the predetermined range is displayed centering on the current position. Moreover, if the character code and the symbolic code are contained in the map data read from DRAM12, the pattern corresponding to these character codes and a symbolic code will be read from kanji font ROM14, and notations, such as alphabetic characters, such as the name of a place, and a school, will be displayed on liquid crystal display 8A with a map. Moreover, if a sequential change of the map and the current position which are displayed on liquid crystal display 8A is made according to transit of a car, for example, a crossing is approached, voice guidance of "being the left about what ******** in what 100 meters about" will be performed, and a user will be certainly guided to the destination.

[0008]

[Problem(s) to be Solved by the Invention] However, in the path planning equipment of the above-mentioned conventional example, it did not show around about through what kind of the root voice guidance after performing path planning is only performed at the inlet port of a highway, an outlet, the branch point, etc. each time, and it goes to the destination in the whole guidance path. For this reason, the user had the problem that the whole guidance path had to be checked on the map displayed on the liquid crystal display.

[0009] After this invention solves such a conventional problem and performs path

planning, it aims at offering the path planning guide apparatus with which a user can recognize the outline of a guidance path easily, and its approach.

[0010]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the path planning guide apparatus of this invention A path planning means to search for the guidance path from an origin to the destination, and a road cost count means to calculate the road cost which shows guidance need, respectively about two or more roads on said guidance path for which it was searched, A road selection means to choose the road of one or more high high orders of road cost from said calculated road costs, It has a voice guidance means to perform voice guidance about said selected road. When guidance need is judged using the road cost of a different concept from the link cost in path planning, and road cost chooses one or more high namely, roads where guidance need is high and carries out voice guidance A user can recognize easily through which root it goes to the destination etc., and can be concentrated on operation in comfort.

[0011] Moreover, the path planning guide apparatus of this invention is characterized by multiplying the mileage of each of two or more of said roads by the weighting factor for every road classification, and performing count of said road cost, and the road where mileage is long is a road it runs for a long time, and rather than a general path, since the directions of a highway are main roads in a guidance path, it can make a judgment of road cost, i.e., guidance need, exactly.

[0012] moreover, when two or more turnpikes are included on said guidance path, the path planning guide apparatus of this invention By being characterized by setting road cost as max to the first turnpike, and setting road cost as max to the first turnpike It can recognize easily what for voice guidance of the first turnpike to surely be carried out,

and run toward which turnpike, and through which turnpike it goes to the destination etc. again.

[0013] Moreover, it is characterized by totaling the path planning guide apparatus of this invention, and considering that general paths other than a national highway are one road in count of said road cost, and since general paths other than a national highway are the roads of a city area with much left turn and right-turn etc. and are not so important, suppose that it collects into one road.

[0014] Moreover, it is not characterized by excepting the path planning guide apparatus of this invention from count of road cost about the road below a predetermined rate to a total process distance of a guidance path, and since the road where distance is short is not so important, suppose that it is excepted from count of road cost.

[0015] Moreover, it is not characterized by the path planning guide apparatus of this invention reducing road cost at a predetermined rate on the occasion of count of road cost about the road below a predetermined rate to a total process distance of a guidance path, and the comparatively short road of distance reduces road cost, and, if possible, is made not to be chosen since it is not so important.

[0016] Moreover, since it becomes important information from what interchange it should ride when it is characterized by carrying out voice guidance of the name of entrance interchange (a lamp is included) with the name of the road when the turnpike is included by said selected road and goes into a turnpike, suppose the path planning guide apparatus of this invention that voice guidance of the name of entrance interchange is carried out with the name of a road.

[0017] Moreover, when the path planning guide apparatus of this invention has two or more said selected roads, it will be characterized by carrying out voice guidance at the

order of a transit path, and it can be recognized easily through which root it goes to the destination etc.

[0018] moreover, about two or more roads on the guidance path from the origin obtained by carrying out the path planning of this invention to the destination Road cost is calculated by multiplying the mileage of each of two or more of said roads by the weighting factor for every road classification. When it is characterized by choosing the road of one or more high high orders of said road cost, and performing voice guidance, and road cost chooses one or more high namely, roads where guidance need is high and carries out voice guidance A user can recognize easily through which root it goes to the destination etc., and can be concentrated on operation in comfort.

[0019] Moreover, this invention is the program which realized the above-mentioned path planning guide apparatus or the above-mentioned path planning guidance approach by software, and is the record medium which recorded that program, and this invention can be used for it also with other path planning guide apparatus or navigation equipment by using this program or record medium.

[0020]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained with reference to a drawing. Drawing 1 shows the configuration of the navigation equipment for mount equipped with the path planning guide apparatus in the gestalt of operation of this invention. In drawing 1 , the map data acquisition section 101 is a communication device which downloads map data from the server of the drive equipment which reads map data from a storage like CD-ROM or DVD-ROM, or the exterior. The current position detecting element 102 detects the current position of a car based on a speed sensor, a bearing sensor, and the signal from a GPS receiver. Displays

103 are displays, such as a liquid crystal panel which displays the road map corresponding to the detected current position with the current position and the guidance path of a car, or an organic EL panel. The actuation input section 104 is the touch panel and remote control which carry out an input setup of the destination or various kinds of instructions. A control unit 105 is a microcomputer which controls the whole equipment. A store 106 memorizes map data and activity data, and record media, such as a hard disk, ROM and RAM, a flash memory, and a memory card, are used suitably. The path planning means 107 is what searches for the guidance path from an origin to the destination, as the conventional technique explained. The road cost count means 108 The road cost which shows guidance need, respectively about two or more roads on the guidance path for which it was searched is calculated, the road selection means 109 chooses the road of one or more high high orders of road cost from the calculated road costs, and these are realized by software. The interior 109 of a voice proposal is equipped with a voice processor and a loudspeaker, and outputs as voice the voice data memorized by the store 106.

[0021] Since overall actuation of the navigation equipment constituted as mentioned above is the same as that of the above-mentioned conventional example, below, path guidance actuation of the path planning guide apparatus which is the theme of this invention is explained with reference to drawing 5 from drawing 2 . The path guidance actuation in the gestalt of this operation consists of three steps, the guide-passage way name selection processing (step S1) performed after ending path-planning processing, as shown in drawing 2 , the outline road voice guidance processing (step S2) which output the selected road name as voice, and the usual voice guidance processing (step S3) which are performed at the entry of each interchange, an outlet, a crossing, etc.

After the control unit 105 after the path-planning means' 107 searching for the guidance path from an origin to a destination, memorizing the acquired guidance path to storage 106 and displaying on a display 103 reads a guidance path from storage 106 and carries out guide-passage way name selection processing to the road cost count means 108 and the road selection means 109, it makes the selected road name etc. output from the interior 110 of a voice proposal.

[0022] Drawing 3 shows guide passage way name selection processing. First, the road cost which shows guidance need, respectively about two or more roads on the guidance path for which it was searched is calculated (step S11). Count of the road cost about each road is performed by multiplying by the weighting factor for every road classification to the total mileage (sum total of the distance of the small section when a route number is the same at and constitutes the same route road) of the road set up for every road classification, respectively. For example, as shown in drawing 4 , in the case of general paths other than a national highway, as a weighting factor, 0.2 is set up for the road total mileage which totaled all the routes. If general paths other than a national highway are removed, as for the national highway, 0.8 and the high-speed path between cities are set [0.6 and a general charged path] up for 0.7 and a city high-speed path with 1.0 as a weighting factor for the road total mileage adding the distance according to route number of each road. After calculation of road cost, when the road is a turnpike (a general charged path, a city high-speed path, high-speed path between cities), the name of (step S12) and its entrance interchange is acquired (step S13).

[0023] Computation of the above road cost is performed to all the roads on a guidance path (step S14), road cost is collectively memorized for every route number (step S15), and the following processings are repeated until the conditions specified about each

road are fulfilled (step S16). First, it investigates whether the road concerned is the first turnpike (step S17), and comes out so, and, as for a certain case, the road cost of the road is set as max (step S18). By this, the first turnpike will surely be chosen. Next, to a total process distance of the guidance path for which it was searched, it investigates [predetermined] whether it is the following comparatively (for example, 5%) (step S19), and comes out so, and in a certain case, the road concerned makes road cost of the road zero (step S20), and excepts from the candidate for selection. Next, to a total process distance of the guidance path searched for the road concerned, it investigates [predetermined] whether it is the following comparatively (for example, 10%) (step S21), and comes out so, and in a certain case, predetermined reduces the road cost of the road comparatively (for example, 1/2) (step S22), and possibility that the road will be chosen is reduced by half in it.

[0024] After following all the roads that memorized these processings (step S23), the road of two high high orders of road cost is extracted out of each road, and when road cost is the same, when a weighting factor is still the same, the road of two high orders is extracted to an appearance order the one where a weighting factor is higher (step S24). As shown in drawing 5 , the guidance path for which it was searched Therefore, 10km of a general path (1), If road cost is calculated by multiplying each distance by the weighting factor when consisting of 15km of a national highway (1), 20km of a city high-speed path, 30km of the high-speed path between cities, 20km of a general path (2), and 15km of a national highway (2) Since a general path (1) is added together with a general path (2) and is set to a total of 30km, the high-speed path between "16" cities is set to "30", a national highway (2) is set to "9" by "9" and the city high-speed path, and, as for the ranking, "6" and a national highway (1) become the sequence of the high-

speed path between cities, a city high-speed path, a national highway (1), a national highway (2), and a general path Therefore, the road of two high orders becomes, and the name of the extracted road and entrance interchange is arranged in the high-speed path between cities, and a city high-speed path in order of a path, and it outputs it to them (step S25). In the above-mentioned example, the voice data of the name and name A-IC of entrance interchange of a city high-speed path, and the name of the high-speed path between cities is outputted. And based on this voice data, the voice guidance "they are a metropolitan high-speed OO lamp and the root passing through that point Tomei Expressway" is outputted.

[0025] In addition, three or four are sufficient as the road name which carries out voice guidance. Moreover, the road name which carries out voice guidance of the case of the root only passing through general paths other than a national highway or the case of the root passing through the only route is set to one, for example, becomes like "it is the root passing through a general path", and "being the root passing through a national highway (xx ****)."

[0026] Thus, since according to the gestalt of this operation road cost is calculated by multiplying the mileage of each road by the weighting factor for every road classification, the road of one or more high high orders of road cost is chosen and voice guidance is performed about two or more roads on the guidance path from the origin obtained by carrying out path planning to the destination, a user can recognize easily through which root it goes to the destination.

[0027] In addition, although the example applied to the navigation for mount explained the path planning guide apparatus with the above-mentioned gestalt of this operation, this invention is applicable also to the navigation equipment of cover halfs, such as

portable navigation equipment and a drive-in.

[0028]

[Effect of the Invention] A path planning means by which this invention searches for the guidance path from an origin to the destination as explained above, A road cost count means to calculate the road cost which shows guidance need, respectively about two or more roads on the guidance path for which it was searched, A road selection means to choose the road of one or more high high orders of road cost from the calculated road costs, They are the path planning guide apparatus equipped with a voice guidance means to perform voice guidance about the selected road, and its approach. When road cost chooses one or more high namely, roads where guidance need is high and carries out voice guidance using the road cost which judges guidance need, a user can recognize easily through which root it goes to the destination, and can be concentrated on operation in comfort.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The block diagram showing the configuration of the navigation equipment for mount equipped with the path planning guide apparatus in the gestalt of operation of this invention

[Drawing 2] The flow Fig. showing path guidance processing of the path planning guide apparatus in the gestalt of operation of this invention

[Drawing 3] The flow Fig. showing guide passage way name selection processing of the path planning guide apparatus in the gestalt of operation of this invention

[Drawing 4] The table Fig. used for road cost count of the guide passage way name selection processing in the gestalt of operation of this invention

[Drawing 5] The mimetic diagram showing an example of the road cost count result of the guide passage way name selection processing in the gestalt of operation of this invention

[Drawing 6] The block diagram showing the configuration of conventional navigation equipment

[Drawing 7] The mimetic diagram showing the configuration of the map data in conventional navigation equipment

[Drawing 8] The mimetic diagram showing the node connection data in path planning processing of conventional navigation equipment

[Drawing 9] The table Fig. showing the relation of whenever [width-of-street / in path planning processing of conventional navigation equipment /, and setting speed]

[Description of Notations]

101 Map Data Acquisition Section

102 Current Position Detecting Element

103 Display

104 Actuation Input Section

105 Control Unit

106 Storage

107 Path Planning Means

108 Road Cost Count Means

109 Road Selection Means

110 Interior of Voice Proposal